

What is claimed is:

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1 1. A method of repairing a mitral valve in the heart of a patient, such method
2 comprising the steps of:

3 inserting a catheter through the atrium to the mitral valve, the catheter having a
4 distal end and a proximal end;

5 gripping opposed leaflets of the mitral valve with the distal end of the catheter so as
6 to effectively juxtapose the opposed leaflets at a point thereof; and

7 fastening the opposed leaflets at said point.

1 2. The method of claim 1, wherein the step of gripping is performed while the heart is
2 beating.

1 3. The method of claim 2, wherein the distal end of the catheter includes opposed
2 openings and a suction lumen, and wherein suction is applied through the lumen to draw
3 said opposed leaflets together.

1 4. The method of claim 3, wherein the step of fastening includes stapling.

1 5. The method of claim 4, wherein the stapling is effected by inserting a stapling
2 device to said point from a direction opposite the direction in which the catheter was
3 inserted.

1 6. The method of claim 5, wherein said catheter further comprises means for extending
2 a guide wire beyond the point of juxtaposition, and the step of stapling includes inserting
3 said stapling device along the guide wire to guide said stapling device to said point.

1 7. The method of claim 5, wherein the stapling device includes jaws actuated by a
2 balloon such that inflation of the balloon deploys a staple through the leaflets.
3

1 8. The method of claim 2, wherein the step of fastening is effected by the catheter.

1 9. The method of claim 8, wherein the step of fastening is effected by deploying a
2 shape memory fastener such as a staple or rivet from within the catheter.

1 10. The method of claim 9, wherein the shape memory fastener is deployed from the
2 distal end of the catheter by the distal translation of a placement device.

1 11. The method of claim 10, wherein the placement device is a plunger..

1 12. The method of claim 8, wherein a fastener is deployed from the distal end of the
2 catheter by translation and rotation of a placement device in the distal end of the catheter.

1 13. The method of claim 12, wherein the placement device is a telescoping cylinder.

1 14. The method of claim 2, wherein the catheter includes a suction lumen, and further
2 comprising the step of inflating an obstruction balloon at said distal end of the catheter to
3 define lateral suction paths, and wherein the step of gripping opposed leaflets of the mitral
4 valve is performed by capturing mitral valve tissue with said suction paths against the distal
5 end of the catheter.

1 15. The method of claim 14, further comprising the step of providing a mechanical
2 fastening assembly in said distal end, and wherein the step of fastening is performed using
3 said mechanical fastening assembly.

1 16. The method of claim 15, further including the step of obstructing the end of the
2 catheter with a balloon to deflect ends of the fastener into the leaflets.

1 17. The method of claim 9, wherein the shape memory fastener is formed of a material
2 selected from the group consisting of superelastic material and shape memory alloy
3 material.

1 18. A method of repairing a mitral valve in the heart of a patient, such method
2 comprising the steps of:
3 inserting a catheter along the venous system of the patient to approach the mitral
4 valve through the atrium;
5 applying suction at a distal end of the catheter to draw opposed leaflets of the mitral
6 valve into contact;
7 *al* extending a guide wire from the catheter into the ventricle and along the arterial
8 system of the patient; and
9 guiding a stapling device along said guide wire to the opposed leaflets to staple the
10 opposed leaflets together while the heart is beating.

1 19. The method of claim 18, wherein the stapling device includes a stapling mechanism
2 actuated by a balloon such that inflation of the balloon deploys a staple pin to the leaflets.

1 20. A method of repairing a mitral valve in the heart of a patient, such method
2 comprising the steps of:
3 inserting a catheter along the venous system of the patient to approach the mitral
4 valve through the atrium, the catheter having a distal end and a proximal end, the catheter
5 containing a fastener, and the catheter also having a balloon, a fluid inflation line, and a
6 plunger device attached thereto;
7 applying suction at the distal end of the catheter to draw opposed leaflets of the
8 mitral valve into contact;
9 inflating the balloon via the fluid inflation line;
10 *al* using the plunger to move the fastener distally out of the catheter; and
11 causing the fastener to curl around the inflated balloon such that its ends penetrate
12 and fasten together the opposed leaflets.

1 21. A diagnostic method for repair of a mitral valve defect, such method comprising the
2 steps of:
3 visualizing mitral valve function by transesophageal echocardiography;
4 inserting a catheter along the venous system of the patient to the mitral valve;

5 applying suction at the tip of the catheter to draw opposed leaflets of the valve
6 together at a selected point;
7 visualizing mitral valve function by transesophageal echocardiography to confirm
8 the efficacy of fastening the selected point to repair the defect; and
9 fastening the opposed leaflets at said point.

1 22. An endovascular device for cardiac treatment, such device comprising:
2 an elongated catheter body adapted for percutaneous insertion along the venous
3 system of a patient to the heart; and
4 a suction assembly disposed at a distal end of said catheter body, the suction
5 assembly being effective to define negative flow into said catheter body along opposed sides
6 thereof,
7 whereby insertion of the catheter into the atrium with the distal end of the catheter
8 positioned in the mitral valve is effective to draw opposed leaflets of said mitral valve
9 together in juxtaposition for simulating an Alfieri leaflet stitch repair.

1 23. The device of claim 22, wherein the distal end of the catheter includes opposed
2 openings that provide a suction force, and wherein said distal end of the catheter has a
3 preformed contour effective upon penetration of the atrial septum to position the distal end
4 of the contour in the mitral valve.

1 24. The device of claim 22, further comprising means in said catheter for
2 accommodating a guide wire.

1 25. The device of claim 24, further comprising means for advancing a guide wire
2 through said catheter and along the arterial tree of the patient.

1 26. The device of claim 25, further comprising a stapling device adapted for
2 percutaneous insertion and for travel along said guide wire such that the stapling device
3 may be positioned to staple the opposed leaflets drawn together by the distal end of the
4 catheter assembly.

1 27. A method of repairing a mitral valve, such method comprising the steps of:
2 immobilizing opposed leaflets of the mitral valve with an endovascular catheter
3 assembly inserted from a first direction; and
4 stapling the immobilized leaflets with a stapling device inserted from a direction
5 opposite to said first direction.

1 28. The method of claim 27, wherein the step of stapling is performed by guiding a
2 stapling device to a tip region of the catheter assembly along a transcatheter wire.

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